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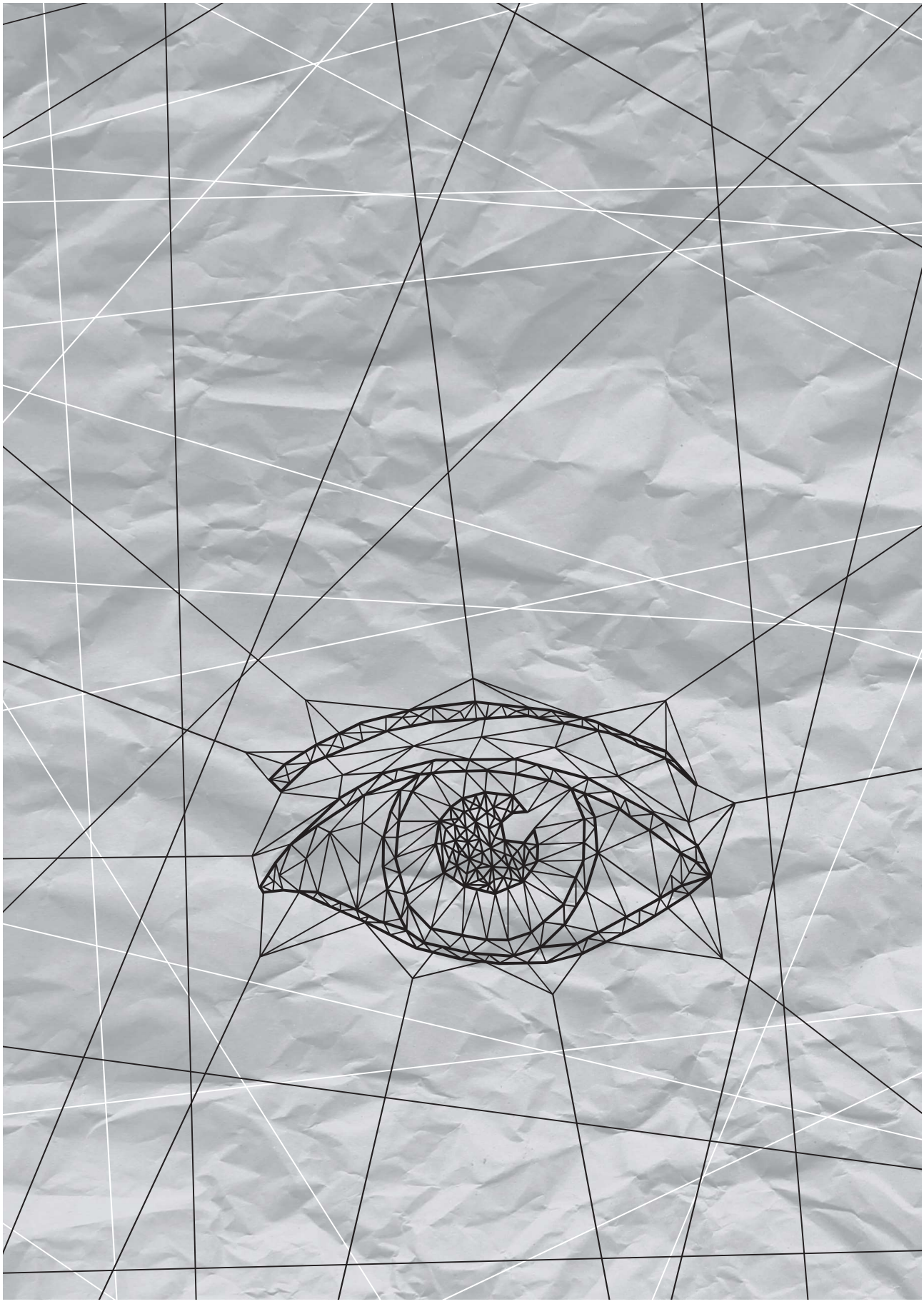

Chapter 3

The spillover effect of team transactive memory: A study of inter-team, boundary spanning effectiveness[3]

[3] This chapter is based on Van Berkel, F., Ferguson, J.E., Groenewegen, P. "The spillover effect of team transactive memory: A study of inter-team, boundary spanning effectiveness". Previously reviewed by *Journal of Management* and finalized for submission to another journal.

ABSTRACT

A central question in current-day organizing relates to the ability to recognize and utilize organizational knowledge, which is conceptualized as transactive memory. Transactive memory literature so far has predominantly sought to explain internal team processes. However, as work increasingly spans multiple teams, new challenges arise related to the development, functioning, and performance effects of transactive memory across teams. This study takes a relational, multi-team perspective to study the effect of team transactive memory on boundary spanning effectiveness, conceptualized as a 'spillover effect'. We conducted a survey-based study among 73 teams within three companies to determine the effects of transactive memory on team engagement in boundary spanning relationships with other teams in the organization. Our results reveal that team transactive memory is positively associated with external articulation of team knowledge and expertise, inter-team knowledge sharing effectiveness, and teams' external influence on the course of action and decision making in other teams. We thereby respond to recent calls for the identification of internal team dynamics as antecedents of boundary spanning effectiveness, and contribute to literature on transactive memory by explaining how team-level transactive memory can improve relationships and knowledge processes between teams. In so doing, we provide a novel contribution by explaining team transactive memory processes as a catalyst for boundary spanning. Such understanding is of key significance, given the increasing cross-team organization of work.

INTRODUCTION

Team performance largely depends on the ability of team members to develop effective transactive memory (TM), i.e., whether they can recognize and utilize each others' knowledge (Faraj & Sproull, 2000; A. C. Hood, Bachrach, & Lewis, 2014; Lewis, 2004; Moreland & Myaskovsky, 2000). So far, TM research has emphasized internal team processes (e.g., Austin, 2003; Pearsall & Ellis, 2006; Zhang, Hempel, Han, & Tjosvold, 2007), and the cognitive processes within groups to explain TM development (Heavey & Simsek, 2014; Hollingshead, 2001; Pearsall, Ellis, & Bell, 2010). However, to date it remains unclear how TM functions at the organizational level. This is surprising, given the proven significance of TM to team performance (Faraj & Sproull, 2000), and the need for collaboration across team boundaries to realize tasks (e.g., Ancona & Caldwell, 1992; Marrone, 2010).

Teams are groups of professionals who are bounded to one another through specific task allocations for which they share responsibility (Mathieu, Maynard, Rapp, & Gilson, 2008). Teams provide the structural conditions for team members to meet face-to-face, and to generate a basis of mutual knowledge related to shared tasks. Indeed, direct communication and mutual knowledge has proven beneficial to TM effectiveness (Lewis, 2004). However, TM development within teams is also likely to have effects in a broader organizational context (Argote, 2012; Healey, Hodgkinson, & Teo, 2009; Mell, van Knippenberg, van Ginkel, & Heugens, 2014). Namely, to access task-related knowledge, team members often need to extend beyond team boundaries and turn toward the broader organizational level (Argote et al., 2003). Moreover, team-level tasks are input for wider organizational goals (Davison et al., 2012). Therefore, the relevance of what happens inside teams is by no means restricted to team boundaries.

At the organizational level, the number of opportunities for face-to-face communication decreases, and organizational members are bounded in the ability to engage in relations with actors from other, more distant parts of the organization (Hansen, 1999). These circumstances obstruct the creation of mutual knowledge, which means that individuals potentially lack awareness of what others know or can contribute (Cramton, 2001). Therefore, within organizations, extension of TM to larger entities or the whole organization clearly has its limitations (Jackson & Klobas, 2008; Moreland & Argote, 2003; Nevo & Wand, 2005). To understand how these limitations can be overcome, we focus on relationships between teams. By studying team boundary spanning in particular, we extend insights on TM effects beyond the team-level.

Team boundary spanning is defined as actions to establish relationships with external actors in order to achieve task-related goals and performance objectives (Ancona & Caldwell, 1992). Although boundary spanning is often directed at the external environment, teams' engagement in boundary spanning also depends on internal team dynamics, such as leaders' behavior, the functional background of team members, or diversity of expertise among team members (Choi, 2002; Klein & Kozlowski, 2000; Marrone, 2010). By adopting a relational, multiple-team approach, we aim to identify the 'spillover effects' of team transactive memory on boundary spanning relationships. Spillover effects relate to TM beyond team boundaries, and which emerge through social relationships (Phelps et al., 2012). We conceptualized these effects as the external articulation of knowledge to other teams, the quality of inter-team communication, the external influence of teams on the course of actions and decisions in other teams, and knowledge sharing effectiveness between teams, which we studied through survey research among 73 teams within three companies.

By providing a better understanding of TM spillover effects on boundary spanning across teams, we respond to recent calls for identifying internal team dynamics as antecedents of boundary spanning (Choi, 2002; Edmondson, 1999; Klein & Kozlowski, 2000; Marrone, 2010). This can also help us understand how TM can improve knowledge processes on a larger, organizational scale, while at the same time sustaining it at a team-level. Our research thereby offers important implications for organizations relying on multiple teams for the transfer and exchange of valuable organizational knowledge, as we introduce below.

THEORETICAL BACKGROUND

Transactive memory: Does it work for teams as well as organizations?

Transactive memory embodies the location and combination of shared and differentiated knowledge, as well as the communication and coordination of knowledge within groups. TM enables group members to encode, store, and retrieve knowledge from different, but complementary domains of expertise toward group tasks (Kotlarsky et al., 2012). Functional TM provides members with an overview and understanding of member-expertise associations and provides access to a greater diversity and depth of knowledge than any single member could possess (Lewis & Herndon, 2011).

An important domain of transactive memory research relates to team performance. Namely, individuals operating within teams are generally well-equipped to create mutual knowledge through frequency of contact (Cramton, 2001; Faraj & Sproull, 2000), and to apply this knowledge to team tasks. Indeed, prior research has established that transactive memory positively affects team performance in multiple ways. For example, transactive memory processes enhance performance when new team knowledge is integrated by individuals with relevant prior expertise, and who can thereby quickly retrieve, communicate, and integrate it with other task-related knowledge (Faraj & Sproull, 2000). Thus, transactive memory enables accurate and efficient utilization of available knowledge from teams' experts (Heavey & Simsek, 2014; Moreland & Myaskovsky, 2000). Transactive memory can also contribute to team performance by reducing coordination miscues (Austin, 2003), minimizing loss of knowledge resources, and enabling functional team interactions (A. C. Hood et al., 2014; Lewis, Belliveau, Herndon, & Keller, 2007). TM has thus been established as an important phenomenon, but has almost solely been studied as part of internal team processes.

One of the reasons for TM research to focus on teams is that TM functions most effectively in small groups with opportunities for direct communication and insight in each other's knowledge. For example, Lewis (2004) showed that the identified performance effects of transactive memory dissolve when actors are not involved in frequent, face-to-face communication. This is rooted in the well-established idea that team members, who have more opportunities to meet and communicate face-to-face, also have more opportunities to exchange and validate their knowledge during shared tasks, discussions, or decision making (Stewart & Stasser, 1995). Thereby strengthening awareness of who holds up what type of knowledge and expertise. In other words, within teams it is easier to identify, recognize, retrieve, and utilize expertise (Faraj & Sproull, 2000).

Thus, while prior studies on TM have been valuable to understanding team-level knowledge processes, imposing such boundaries on the concept is in reality somewhat artificial, given that knowledge also flows beyond the boundaries of teams (Borgatti & Cross, 2003; Hansen, 1999; Phelps et al., 2012). Therefore, it makes sense to also focus on the effects of transactive memory on inter-team relationships, drawing on the attributes of transactive memory within teams. However, there are potential barriers to extending transactive memory processes to a broader level. For example, beyond team-level, the scale of the overview required to allocate and retrieve knowledge from

members within every subgroup might simply be too large for any individual's memory capacity (Nevo & Wand, 2005).

To alleviate such problems, many scholars and practitioners have advocated the use of organization-wide information systems (Jackson & Klobas, 2008; Nevo & Wand, 2005; Stein & Zwass, 1995). Despite some early claims of success, a large body of work shows that information systems are limited in terms of their contribution to transactive memory processes at the organization level (Moreland, 2013; Moreland & Argote, 2003; Stewart, 2001). Thus, while many organizations have made vast investments in time, effort, and money to create and maintain 'organizational memory systems', they have often yielded disappointing performance outcomes (Moreland, 2013; Moreland & Argote, 2003)

Many limitations inherent to these technology-driven systems are rooted in the fact that not all knowledge can be captured or stored (Alavi & Leidner, 2001). Whereas information systems can deal effectively with the storage of data and facts (McIver, Lengnick-Hall, Lengnick-Hall, & Ramachandran, 2013), knowledge also contains less explicit dimensions (Nonaka & Von Krogh, 2009) that can only be exchanged or applied through social relationships and interaction within and beyond teams (Phelps et al., 2012). Therefore, we move away from the idea of an overarching organizational memory system, but instead we adopt a multi-team perspective to study the 'spillover effects' of transactive memory on the efficacy of boundary spanning relationships at an inter-team-level. We shall now introduce the concept of boundary spanning in terms of internal and inter-team processes, after which we summarize our theoretical premises through the hypotheses guiding our study.

Boundary spanning and internal team dynamics

Distinguishing teams from their external environment assumes a boundary between the inside (team) and the outside (other teams or departments). Boundaries emerge between organizational domains as a result of potential discontinuities in for example work, tasks, functionality, expertise, or objectives (Watson-Manheim, Chudoba, & Crowston, 2012). Within boundaries, shared understanding or mutual objectives can generate coherence, feelings of shared identity, and knowledge about how to access resources (Ashforth, Kreiner, & Fugate, 2000), which can increase team performance. However, team performance is not merely an outcome of the internal functioning of teams, but in order to achieve goals, external team relationships are equally important (e.g., Marrone, 2010; Oh, Chung, & Labianca, 2004). Thus, individuals have to simultaneously work across

organizational boundaries in order to exchange knowledge and coordinate activities, which is called boundary spanning (Ancona, 1990; Joshi, Pandey, & Han, 2009; Marrone, 2010; Marrone, Tesluk, & Carson, 2007).

Boundary spanning is defined as the actions to establish relationships and interactions with external actors, toward meeting task-related team goals and performance objectives (Ancona & Caldwell, 1992). Boundary spanning relationships reflect the nature of interactions with the team's environment, linking teams with other parts of the organization. Typical boundary spanning relationships involve external interaction directed at representation (i.e., convincing other parties of team decisions), coordination (i.e., adjustment of tasks and activities to accomplish individually and jointly set task goals), and knowledge exchange (Ancona & Caldwell, 1992; Borgatti & Cross, 2003; Hansen et al., 2005; Marrone, 2010). Prior studies have also examined the determinants of boundary spanning (for an overview see Joshi et al., 2009). Boundary spanning effectiveness can depend on internal team dynamics (Choi, 2002; Marrone, 2010), which include teams' internal behavior, perceptions, composition, and attributes (Klein & Kozlowski, 2000; Marrone, 2010).

For example, a team leaders' behavior and perceptions can be a critical influence on the extent to which the team as a whole interacts with its external environment (Ancona, 1990). Moreover, Edmondson (1999) and Keller (2001) found that functional diverse teams conducted more external activities as compared to teams with less functional diversity. Within teams, the diversity in members' expertise can also promote a team's connections to external actors (Arrow & McGrath, 1995). Finally, knowledge integration often takes place within teams before it is exchanged and integrated with organizational members from other teams (Grant, 1996; Huang & Newell, 2003). Thus, the internal dynamics of teams can be an important catalyst for the extent to which teams engage in boundary spanning and the effectiveness of these activities. Therefore, in line with past research (Marrone et al., 2007; Oh et al., 2004; Tsai, 2000) we conceptualize boundary spanning as an aggregate team-level phenomenon in order to determine how team-level transactive memory can influence the effectiveness of team boundary spanning. In the next section we integrate our two guiding concepts, explaining how transactive memory can function as a catalyst for boundary spanning.

Transactive memory: A catalyst for boundary spanning effectiveness

Teams that engage in boundary spanning are more effective in managing and influencing their external environment, and the effectiveness of boundary spanning can depend

on internal team processes. Given the significance of transactive memory to teams' relationships, we consider how team transactive memory affect the course of actions and decisions in *other* teams through boundary spanning relationships.

As indicated above, some scholars have studied the effects of transactive memory beyond team boundaries (Argote & Ren, 2012; Healey et al., 2009; Mell et al., 2014). For instance, in their exploratory study on multi-team response systems in the context of civil emergencies, Healey et al. (2009) were among the first to explain that transactive memory development is crucial not only for team performance, but also for the outcomes of wider, multi-team systems. Most recently, Mell et al. (2014) hypothesized that individual-level boundary spanning depends on team members' positions within a team's transactive memory. Although these studies provide ample recognition *that* transactive memory has an effect outside team boundaries, understanding of *how* team transactive memory affects their external environment remains unaddressed. Addressing this gap, our research therefore seeks to respond to the question:

How does a transactive memory influence boundary spanning effectiveness?

From team-based, knowledge oriented research we already know that boundary spanning between teams is particularly important, because it can facilitate effective knowledge sharing across organizational units (Hansen, 1999; Malhotra & Majchrzak, 2004). Moreover, the extent to which teams span boundaries, particularly through knowledge sharing, can lead to the generation of new knowledge and innovation (Tsai, 2000; Tsai & Ghoshal, 1998). In other words, teams engaging in boundary spanning can benefit from each other's knowledge. Therefore, in the current research, we focus on transactive memory and its influence on boundary spanning effectiveness between teams, to establish whether knowledge sharing relationships support teams to develop new insights, find new ways of performing, and improve their effectiveness of task performance.

As mentioned earlier, a well-functioning transactive memory provides teams with a clear overview of expertise and access to a greater diversity and depth of knowledge than any single member could possess (Lewis & Herndon, 2011). We therefore expect that teams with well-functioning transactive memory can effectively share team knowledge with other teams by more quickly making available a greater diversity of internally-held knowledge to members from other teams. In short, team transactive memory will

positively influence knowledge sharing effectiveness between teams, and consequently team knowledge will be more beneficial to other teams. This brings us to the following hypothesis:

H1a: Transactive memory is positively related to knowledge sharing effectiveness between teams.

Team boundary spanning also involves persuading and influencing actors or groups in the external environment (Ancona & Caldwell, 1992). These kinds of activities can be directed at upper management to obtain support for team decisions or to gain access to important resources. Furthermore, they can also involve the coordination of work activities with interdependent teams to accomplish individually and jointly set task goals (Ancona, 1990; Tsai, 2002). However, in order to be effective, teams need to be able to influence actions and decisions in other teams, regardless at whom these activities are directed (Marrone, 2010). Consequently, we also conceptualize boundary spanning effectiveness as the ability of teams to influence the course of actions and decisions in *other* teams. We expect that a well-functioning transactive memory within teams is a foundation for teams' external influence as teams are more influential during boundary spanning in case they can represent their knowledge timely and accurately (Carlile, 2004).This brings us to our second hypothesis.

H1b: Transactive memory is positively related to teams' external influence on other teams.

Transactive memory, external knowledge articulation, and communication

The effectiveness and complexity of boundary spanning, such as coordination and knowledge exchange, depends on knowing what other persons know, being able to gain timely access to others, and recognizing that gaining information from others will not be too costly (Borgatti & Cross, 2003). Moreover, timely recognition of and access to knowledge is determined by the process of knowledge articulation (Hansen, 1999; Willem & Buelens, 2009).

Knowledge articulation is the conversion between individually-held, tacit forms of knowledge, and explicit knowledge (Tell, 2013). In this conversion process, personal knowledge, which is rooted in the accumulated skills, experience, and expertise of

individuals is articulated into more explicit, shared forms of knowledge (Nonaka, Von Krogh, & Voelpel, 2006). This means that knowledge can take on different forms. In other words, it contains both tacit and explicit elements during interaction and problem solving. Although not all individual knowledge can be externalized, much can be articulated and communicated to others when a mutual basis is available (Nonaka & Von Krogh, 2009). This process of external knowledge articulation is therefore relevant in relation to boundary spanning effectiveness between teams.

For example, knowledge articulation enables learning between project teams (Prencipe & Tell, 2001), and allows for better communication and coordination (Foray & Steinmueller, 2001). Knowledge articulation has also been shown to facilitate effective knowledge integration between multi-disciplinary teams (Ratcheva, 2009). Thus, extrapolating on prior findings (Hansen, 1999; Prencipe & Tell, 2001; Ratcheva, 2009; Willem & Buelens, 2009) we expect that the ability of team members to articulate or express to other teams what knowledge, expertise, and skills their team possesses, positively affects knowledge sharing effectiveness. Moreover, a team is likely to more effectively influence the course of actions and decisions in other teams, if they are able to clearly articulate their knowledge. This brings us to the following hypotheses:

H2a: External knowledge articulation is positively related to knowledge sharing effectiveness between teams.

H2b: External knowledge articulation is positively related to teams' external influence on other teams.

Nevertheless, before team knowledge can be expanded to other teams through boundary spanning, individuals have to bring their individually held knowledge to bear. This is more likely to occur within teams, through frequent, face-to-face communication that teams enable, and which allows team members to create an overview of their knowledge, expertise, and skills (Lewis, 2004). Subsequently, this will enhance the ability of team members to articulate team knowledge and expertise to actors from other teams. In other words, external articulation of team knowledge requires the recognition and retrieval of knowledge and expertise from fellow team members. This brings us to the following hypotheses:

H3a: Transactive memory is positively related to external articulation of team knowledge.

H3b: Transactive memory is positively related to knowledge sharing effectiveness between teams through external knowledge articulation.

H3c: Transactive memory is positively related to teams' external influence on other teams through external knowledge articulation.

Finally, we expect that the relationship between transactive memory and knowledge sharing effectiveness is moderated by the frequency, timeliness, and accuracy of inter-team communication. Lewis (2004) shows that within teams, the performance effects of transactive memory dissolve when actors are not involved in frequent face-to-face communication. Similarly, on a wider, organizational scale knowledge sharing is affected by the quality of communication within organizations (van den Hooff & De Ridder, 2004). Therefore, the strength and quality of inter-team communication is expected to be a precondition for effective knowledge sharing between teams. This brings us to our last hypothesis:

Hypothesis 4: The positive effect of transactive memory on knowledge sharing effectiveness becomes stronger as the quality of inter-team communication increases.

Figure 3.1 summarizes our conceptual model, which we tested through a quantitative study, as we now explain.

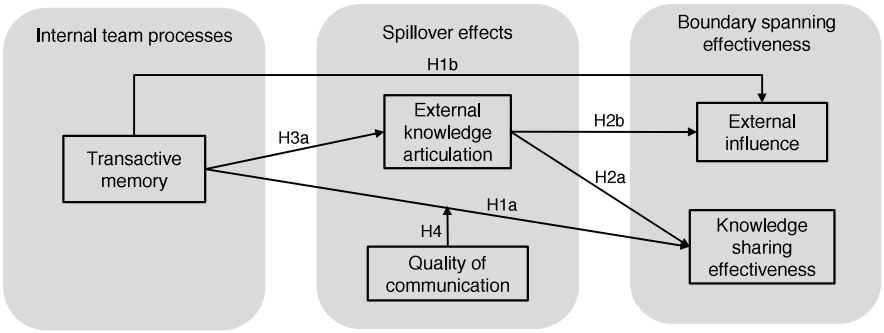

Figure 3.1. *Conceptual model*

METHODS

Samples and procedure

Our case study sample consists of 73 teams from three organizations, comprising respectively 30 teams from a municipal public works department, 20 teams from an insurance company, and 23 teams from a division of a Dutch banking company. All employees of our case study organizations were approached to participate in the study, receiving a questionnaire through their company email address upon approval by top-level management. Participation was voluntary, and confidentiality was assured; only aggregated responses at the organizational or departmental level were reported back.

The unit of analysis was the team-level, so it was necessary that the response was evenly and representatively distributed across teams. Therefore, our research assistants, who collected data, were explicitly instructed to follow-up with teams that did not respond at all or minimally. Of 89 teams that we approached, 84 responded. Eventually, a total of 11 teams were deleted from the sample, as their response was too low to yield representative judgments. For the purpose of merging our three samples, we had to determine whether the variances between our samples were equal with the Levene's test of equality of variances. The results of the test showed that for all variables, the resulting P-value of the Levene's test were insignificant, which means that the null hypothesis of equal variances was confirmed, justifying our sample merger.

Measures

Similarly to Evans, Hendron, and Oldroyd (2014) we developed a questionnaire that combines items based on teams' self-reports (i.e., the extent to which items were applicable to respondents' *own* team) as well as items that were based on response from *other* teams (i.e., how actors perceived other teams). Namely, two variables (i.e., knowledge sharing effectiveness and quality of inter-team communication) are about the relationships between teams, and therefore regarding these variables we measured relationships between teams (see subsection on inter-team variables). Both teams' self-reports as well as reports from *other* teams reflect high agreement among individual responses (see next section for ICC scores) suggesting that these variables can be aggregated to the team-level (Bliese, 2000; Klein & Kozlowski, 2000).

Team-level variables. In the survey, all items were measured using a 5-point Likert-type scale ranging from 1 (*not at all*) to 5 (*completely*). *Transactive memory* (TM) items

were based on the interrelated transactive memory processes – directory updating, knowledge allocation, and retrieval coordination (Lewis, 2003). Based on these processes, we composed a scale of four items (Cronbach's alpha = .86) based on the scales of Kotlarsky, Van den Hooff, and Houtman (2012) and Faraj and Sproull (2000) which we used in our survey (see Appendix A for the items). An example item is: '*Team members know what task-relevant skills and knowledge other team members possess'.*

External knowledge articulation (Willem & Buelens, 2009) was measured with five items (Cronbach's alpha = .86) and is about the extent to which it is easy and/or difficult for respondents to articulate and explain to other units what knowledge, expertise, and competencies their team possesses, and the extent to which respondents perceive that other teams understand their team knowledge. An example item is: '*We can express and explain what we know to other teams'*.

Team's external influence is measured with five items (Cronbach Alpha = .91) and is about the extent to which respondents perceived that their team has influence on the course of action and decision-making processes within the organization, and specifically on the internal operations within *other* teams. We based this scale on items from a variety of studies (Bacharach & Aiken, 1976; Hinings, Hickson, Pennings, & Schneck, 1974; Perrow, 1970; Salancik & Pfeffer, 1974) on intra-organizational power and influence. An example item is: '*My team has influence on the internal operations of other teams'.*

Inter-team-level. *Quality of inter-team communication* (Gittell, 2001) was measured with three items and is about the extent to which teams communicate *frequently*, *timely*, and *accurately*. An example item is: '*How frequent do employees from [name preselected team] communicate with you*?'. As mentioned earlier, the level of analysis slightly differs from our team-level variables. Namely, the scale is about inter-team relationships and is therefore measured in a different manner. We first asked respondents which teams besides their own they depended on most during the daily execution of their work (respondents could select 1 to 5 teams). Subsequently, the respondents answered the three items regarding the quality of communication with reference to the preselected teams. In the analysis, we aggregated the individual scores to average scores per team. However, these aggregated team scores were based on the scores from individuals from *other* teams instead of scores individuals provided about their *own* team.

Knowledge sharing effectiveness between teams is measured with four items and is about the effect of knowledge sharing on the work of *other* teams, i.e., on the

development of new ways of performing, improvement of work effectiveness, and development of new insights as a result of shared knowledge (Wathne, Roos, & von Krogh, 1996). This scale has a clear inter-team component, and is therefore measured in the same manner as quality of inter-team communication. We first asked respondents which teams besides their own they depended on most during the daily execution of their work (again, respondents could select 1 to 5 teams). Subsequently, respondents answered the four items regarding knowledge sharing effectiveness with reference to the preselected teams. An example item: '*The knowledge I got from [name preselected team] helped me* ***improve my effectiveness*** *in performing my tasks*.'

Reliability analysis and aggregation to team-level

In our research we are interested in team-level scores. Therefore, in the survey we questioned individuals about the characteristics of their team. However, to derive team-level constructs from individual-level data (i.e., individual reports of team characteristics) and assess the appropriateness of our aggregation, we computed the intra-class correlation coefficients for all our variables (Bliese, 2000). The intra-class correlation (ICC) is used as a measure of association when studying the reliability between raters within a group. Hence, it describes how strongly ratings within the same group are similar to each other. The ICC(1)s for TMS, knowledge articulation, and a team's external influence within the organization exceeded the generally accepted cutoff value of .12 (.53 < ICC(1) > .66) (see Table 3.1). This indicates a large within group agreement of team members when they individually scored items about their *own* team.

To assess the appropriateness of using the mean scores per team regarding the quality of communication and knowledge sharing effectiveness, we had to compute the intra-class correlation coefficient in a different manner, namely separately for every team. In these cases, the mean scores per team were based on the scores provided by organizational members who selected the team (task dependency), and who answered the questions regarding quality of communication and knowledge sharing effectiveness for the teams they selected. Thus, mean scores per team were based on the scores of different groups of raters (4 > N < 63). Therefore, we had to calculate the reliability between raters from different groups of raters within each sample (i.e., organization).

For teams' knowledge sharing effectiveness within organization 1 (the public works department), the ICC(1)s exceeded the accepted value of .12 (.18 < ICC1 < .70) except for the ratings regarding one team (ICC1 < .12), which was deleted from the sample. The

ICC(1) values regarding knowledge sharing effectiveness in organization 2 (the insurance company) ranged from .23 to .84. In organization 3 (the division of a banking company) the ICC(1)s for knowledge sharing effectiveness ranged between .28 and .68.

For the quality of communication we calculated the ICC(1)s in the same fashion as for knowledge sharing effectiveness, i.e., we treated the raters of a specific team as a group and calculated the agreement between their ratings of a team. For the quality of communication, the ICC(1)s all exceed the accepted value of . 12 (.14 < ICC(1) < .897), with the exception of the agreement regarding one team (ICC(1) < .12). The scores for this specific team were deleted from the sample. Within the insurance company the ICC(1)s all ranged between .13 and .82. Finally, within the division of the banking company all ICC(1)s exceeded the accepted value of .12 (.13 < ICC(1) < .75).

Thus, these outcomes indicated that data aggregation was justified for all variables. From this moment on we proceeded with the analysis in the aggregated dataset in which our variables were aggregated on the team-level.

Table 3.1. *Intra-class correlation coefficients*

Variables	ICC (1)
Transactive memory system	.60
Knowledge articulation	.54
Team's external influence within organization	.66
Quality of communication	.13 - .90
Knowledge sharing effectiveness	.18 - .84

RESULTS

Bivariate correlations

The means and standard deviations for the variables, as well as the correlations among them, are shown in Table 3.2. The correlations show that *transactive memory* (TM) is significantly associated with *external knowledge articulation* ($\beta = .49$, $p < .01$), *teams' external influence* ($\beta = .35$, $p < .01$), and *knowledge sharing effectiveness between teams* ($\beta = .27$, $p < .05$). Quality of inter-team communication is significantly associated with knowledge sharing effectiveness between teams ($\beta = .57$, $p < .01$). External knowledge articulation is positively correlated with teams' external influence within the organization

(β = .34, p <.01), but unexpectedly the correlation between external knowledge articulation and knowledge sharing effectiveness between teams is not significant.

Table 3.2. *Correlation matrix*

Variable	*M*	*SD*	*a*	1.	2.	3.	4.	5.
1. Transactive memory system	3.58	.44	.86	--				
2. Quality of communication	3.16	.31	.13-.90	.11	--			
3. Knowledge articulation	3.10	.42	.86	.49**	.20	--		
4. Teams' influence within organization	2.89	.58	.91	.35**	.33	.34**	--	
5. Knowledge sharing effectiveness	2.96	.32	.18-.84	.27*	.57**	.14	.18	--

Note. N ranged between 69 and 73. * p < *.05* (1-tailed) ** p < .01 (2-tailed)

Testing of mediation models

Ordinary regression analyses were used to test our mediation hypotheses. Following Baron and Kenny's (1986) causes step approach, the procedure requires the testing of three separate regression equations: (1) the direct effect of *TM* on *teams' influence within the organization* and *knowledge sharing effectiveness between teams*, (2) the direct effect of *TM* on *external knowledge articulation*, and (3) the direct effect of *knowledge articulation* on *teams' influence within the organization* and *knowledge effectiveness between teams*. The significant associations between *TM* on the one hand and *teams' external influence* and *knowledge effectiveness between teams* on the other hand, must become insignificant by adding *external knowledge articulation* to the model (Baron & Kenny, 1986).

The results in Table 3.3 show that as hypothesized TM is positively associated with teams' influence within the organization (β = .35, p <.01) and knowledge articulation (β = .49, p < .01). Moreover, knowledge articulation is positively associated with a teams' influence within the organization (β = .34, p < .01). When the effect of TM on teams' influence within the organization is controlled for knowledge articulation, it becomes insignificant (β = .24, p = .07), which means we can confirm our proposed mediation effect of TM on a team's external influence within the organization through knowledge articulation. Thus, hypotheses 1b, 2b, 3a, and 3c are confirmed.

Furthermore, as hypothesized TM is positively associated with knowledge effectiveness (β = .26, p < .05) and knowledge articulation (β = .49, p < .01). However, in contrast to our expectation, knowledge articulation is not significantly associated with knowledge

effectiveness (β = .24, p > 05). Thus, hypothesis 1a is confirmed and hypothesis 2a is rejected. Consequently, the proposed mediating effect (hypothesis 3b) of knowledge articulation in the relationship between TM and knowledge sharing effectiveness is rejected.

Table 3.3. *Testing mediation model*

Variable Teams' influence within the organization	*B*	*p*
Effect of TMS on teams' influence within the organization (c-path)	.35	.003
Effect of TMS on knowledge articulation (a-path)	.49	.00
Effect of knowledge articulation on teams' influence within the organization (b-path)	.34	.003
Effect of TMS on teams' influence within the organization controlled for knowledge articulation (c'-path)	.24	.07

Variable Knowledge effectiveness	*B*	*p*
Effect of TMS on knowledge effectiveness (c-path)	.27	.07
Effect of TMS on knowledge articulation (a-path)	.49	.00
Effect of knowledge articulation on knowledge effectiveness (b-path)	.14	.24
Effect of TMS on knowledge effectiveness controlled for knowledge articulation (c'-path)	.26	.06

Testing moderation model

As hypothesized we expect that the team's knowledge sharing effectiveness as an effect of transactive memory becomes more effective under conditions of high quality communication (hypothesis 4). The proposed moderation effects required the testing of three steps (see Table 3.4). In model 3, the interaction term of *transactive memory* and *quality of inter-team communication* must be significantly associated with knowledge sharing effectiveness (Baron & Kenny, 1986).

As previously mentioned, transactive memory within a team is positively associated with its knowledge sharing effectiveness (β = .27, p <.05). However, contrary to hypothesis 4, the product of TM and quality of communication does not have a significant effect on knowledge sharing effectiveness (β = .16, p > .05).

Table 3.4. *Testing moderation effects.*

		Standardized coefficients		Unstandardized coefficients	
Model	B	Std. Error	Beta	t	Sig.
1.	(Constant)	.01	.10	.097	.92
	Transactive Memory	.23	.10	.23	2.32	.02
	Quality of Communication	.56	.10	.56	5.70	.00
2.	(Constant)	-.00	.10	-.011	.99
	Transactive Memory	.21	.10	.21	2.12	.038
	Quality of Communication	.51	.10	.51	5.05	.00
	TM * Quality of Communication	.13	.08	.16	1.62	.11

Dependent Variable: Knowledge sharing effectiveness

CONCLUSION AND DISCUSSION

Interpretation: A boundary perspective on team transactive memory

We studied an important issue that research on transactive memories as well as boundary spanning has until now overlooked: the spillover effects of team transactive memory on inter-team boundary spanning relationships. Our study reveals two overarching findings. First, well-functioning transactive memory on the team-level has a positive effect on knowledge sharing effectiveness between teams. Thus, through inter-team knowledge sharing, transactive memories can be beneficial outside team boundaries as it enhances effectiveness, the generation of new knowledge and ways of performing in other teams, deriving from other parts of the organization. Secondly, we found that well-functioning transactive memory within teams has a positive effect on teams' external influence, related to actions and decisions in other teams. Moreover, this relationship is mediated by teams' external knowledge articulation. Initially, transactive memory help teams to internally create a comprehensive overview of and access to teams' knowledge and expertise, and therefore team members are able to more accurately externally articulate team knowledge to actors from other teams. In so doing, teams are more influential within their organization.

In summary, our study provides compelling evidence that team transactive memory can function as a catalyst for team boundary spanning activities and that besides its effect on internal team processes, it has a spillover effect on inter-team relationships.

Strengths and limitations

Our hypotheses – both rejected and confirmed – can be considered in the light of the strengths and limitations of our research, which point to directions for future research. Contrary to our expectations, external knowledge articulation did not contribute to knowledge sharing effectiveness between teams. Furthermore, we did not find an interaction effect of inter-team communication on the relationship between transactive memory within teams and knowledge sharing effectiveness between teams.

These outcomes can be influenced by the use of different methods: teams' *self*-report vs. *other*-reports. Namely, whereas transactive memory, external knowledge articulation, and teams' external influence are derived from teams' self-reports (i.e., the extent to which items were applicable to respondents' *own* team), the quality of inter-team communication, and knowledge sharing effectiveness between teams were based on the response from *other* teams. This combination of teams' self-reports and non-self-reports in one model may have mitigated the results regarding hypothesis 1a, 2a, 3b, and 4.

However, the additional use of response from *other* teams was logical, because we aimed to determine the spillover effects of transactive memory on *other* teams through analyzing the relationships between teams. Therefore, it was necessary to use measures with an evident relational, inter-team component, which is aggregated from reports of individuals from other teams. On the basis of our relational measures, we were able to find a significant relationship between team transactive memory and inter-team knowledge sharing effectiveness. Thus, a relational, inter-team measure of boundary spanning effectiveness can be a reliable (see Table 3.1) and fruitful approach to examine the interplay between internal dynamics (e.g., transactive memory) and inter-team relationships (e.g., knowledge sharing effectiveness).

Moreover, combining different methods can improve the reliability of research by reducing common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), because studies that use the same type of measures find spuriously high correlations (Organ & Ryan, 1995). Specifically, with reference to knowledge sharing, the relationship between knowledge processes within teams and between teams can be confounded by the individual propensity and motivation to share knowledge for other reasons, such as enhancement of reputation, enjoyment of helping others, or self-perception of expertise (Wasko & Faraj, 2005). These potential confounding effects can be encountered by the use of different measures.

Following these arguments, the relationship found between teams' self-reported variables (transactive memory, external knowledge articulation, and teams' external influence) could be affected by common method variance. To rule out potential method effects, in line with Conway and Lance (2010) we demonstrate that our measures are reliable (see Table 3.1), and have construct validity, i.e., measures are conceptually different: *internal* transactive memory vs. *external* knowledge articulation and influence. Additionally, we provide the structure of factor loadings of these variables that show discriminant validity (see appendix B).

Finally, as mentioned in our methods section, the relational measures were based on the scores of respondents who pre-selected teams they perceived they depended on most for the performance of their daily tasks. With regards to these items, we did not ask to *which degree* respondents depended on the pre-selected teams. Therefore, these scores were aggregated from individual scores, which may vary in the degree of dependency. In future research, it is important to measure the degree of dependency and add such information as control variable to the analysis.

Theoretical contributions

Our results yield several contributions, informing research on the consequences of a team transactive memory, as well as the literature on team boundary spanning.

First, we explain how team transactive memory and its spillover effects on inter-team relationships can impact on the organizational level through boundary spanning relationships. To date, research on the outcomes, consequences, and performance effects of transactive memory predominantly focused on internal team processes (Austin, 2003; Faraj & Sproull, 2000; Hollingshead, 2001; Kotlarsky et al., 2012; Lewis, 2004). This focus corresponds to the predominant effectiveness of transactive memory at a team-level, where individuals have more opportunities for frequent, direct, and face-to-face contact (Lewis, 2004). In so doing, they can rely on commonly held knowledge, which increases awareness of what others know or do not know (Cramton, 2001; Fussell & Krauss, 1992). In contrast, at the organizational level, the positive performance effects found at the team-level partly or completely dissolve, because the overview required to allocate and retrieve knowledge from members within such large groups simply surpasses individuals' memory capacity (Jackson & Klobas, 2008; Moreland, 2013; Nevo & Wand, 2005).

Despite the dysfunction of overarching organizational memory systems, our study confirmed that the ability to access, transfer, and apply knowledge extends beyond the

boundaries of teams (e.g., Phelps et al., 2012; Reagans & McEvily, 2003; Wuchty, Jones, & Uzzi, 2007). We connected intra-team processes and inter-team relationships, thereby providing evidence that transactive memory may function most effectively within teams, but can spillover on team boundary spanning at a wider, organizational scale.

From prior studies, we know that boundary spanning with other, more distant parts of the organization can become problematic due to the consequent increase in exchange costs and time investments (Hansen, 1999). This can reduce knowledge benefits (Borgatti & Cross, 2003; Hansen, 1999) and motivation to exchange knowledge beyond team boundaries (Hansen et al., 2005), which can eventually reduce unit performance (Hoegl & Wagner, 2005). Our case study shows that these obstacles to boundary spanning can be mitigated through the spillover effects of team transactive memory, as evidenced through the external articulation of knowledge, teams' external influence, and knowledge sharing effectiveness between teams. Thus, transactive memory within teams can improve communication, coordination, and knowledge processes, and simultaneously enhances boundary spanning effectiveness. Our results therefore show that teams can be the ideal focal point for localization and retrieval of knowledge.

We also contribute to boundary spanning literature by showing the importance of transactive memory for augmenting team boundary spanning effectiveness. Some studies in this domain emphasize the interplay between team engagement in boundary spanning, and the preservation of productive internal dynamics (Choi, 2002; Joshi et al., 2009; Marrone, 2010). Particularly, the role of internal team attributes in supporting a team's competency for boundary spanning has been examined, for instance psychological safety (Edmondson, 1999), group identification (Richter, West, Van Dick, & Dawson, 2006), functional diversity (Keller, 2001), and diversity in expertise and knowledge (Arrow & McGrath, 1995; Joshi et al., 2009). Results from prior studies (Hülsheger et al., 2009; Rulke & Galaskiewicz, 2000) also imply that teams' internal knowledge networks as well as their relationships to others beyond the team are important for understanding knowledge outcomes. However, given the increasing prevalence of task allocation *across* teams, it is important to focus not only on internal team processes, but also the relationships between teams. This study presents such a focus, explaining that internal transactive memory affects engagement beyond team boundaries, and the effectiveness of such engagement. Thus, team interconnectedness enables boundary spanning and increases knowledge benefits, but is catalyzed within the boundaries of teams.

PRACTICAL IMPLICATIONS

This study has implications for organizations that rely on multiple, interdependent teams to realize their strategic goals. Our findings suggest that organizations are likely to benefit from focusing on the mechanisms through which teams effectively fulfill external demands through boundary spanning, and meanwhile preserve the recognition and utilization of knowledge within teams. Moreover, while information systems are useful for sharing facts and data, they are less suited for disclosing action-based knowledge such as employee's expertise and know how (McIver et al., 2013). In fact, our study showed that it was difficult to apply team transactive memory to overarching organizational memory systems, which information systems falsely claim to establish. However, TM did show a propensity to spill over on boundary spanning relationships between teams. By showing how team transactive memory enables productive interactions between team members as well as effective relationships between teams, this study has provided a solution for the optimization of both team and organizational effectiveness.